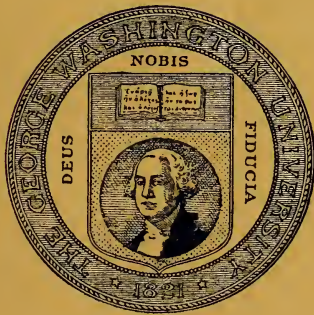


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1916/17

# George Washington University National College of Pharmacy

ANNOUNCEMENT FOR 1916-1917

THE BOARD  
OF THE  
UNIVERSITY OF ILLINOIS



UNIVERSITY OF ILLINOIS

JUN 16 1917

WASHINGTON, D. C.

Washington  
Thur - N. C. or P.  
1916-17



# George Washington University National College of Pharmacy

808 I Street Northwest  
Washington, D. C.

Organized November 11, 1872, as the National College of Pharmacy  
Affiliated February, 1906, with George Washington University

Forty-fifth Annual Circular

# COLLEGE CALENDAR

## Forty-fifth Annual Session, 1916-1917

Entrance Examination, at 1:00 p.m., Thursday, September 14, 1916  
(Lecture Room of the College)

Session begins, Wednesday, September 20, 1916

Thanksgiving Day, holiday. Thursday, November 30, 1916

Christmas Holidays begin, Thursday, December 21, 1916.

(Last lectures, December 20)

Lectures resume, Wednesday, January 3, 1917

Washington's Birthday, holiday, Thursday, February 22, 1917

Annual Examinations of Seniors for graduation, and of Juniors and Freshmen for promotion,  
begin, Monday, May 7, 1917.

Graduation and Close of Session, Wednesday, June 6, 1917.

## PROGRAM OF STUDIES

### *Monday*—FRESHMEN:

10:00 to 11:00, a.m., Botany and Physiology (Lectures and Recitations).

11:00 to 12:00, a.m., Pharmacy (Lectures and Recitations).

12:30 to 4:30, p.m., Pharmacy (Laboratory work).

### JUNIORS:

6:00 to 7:00, p.m., Physics and General Chemistry (Lectures and Recitations).

7:00 to 11:30, p.m., Analytical Chemistry (Lectures, Laboratory and Recitations).

### *Tuesday*—SENIORS:

6:00 to 8:00, p.m., Microscopy (Lectures and Practice).

8:00 to 10:00, p.m., Mercantile Pharmacy (Lectures and Practice).

(From September 26 to February 6, inclusive).

8:00 to 9:00, p.m., Pharmaceutical Jurisprudence (Lectures and Recitations).

(From February 13, to end of term).

### *Wednesday*—JUNIORS:

10:00 to 11:00, a.m., Botany and Materia Medica (Lectures and Recitations).

11:00 to 12:00, a.m., Pharmacy (Lectures and Recitations).

12:30 to 4:30, p.m., Pharmacy (Laboratory Work).

### FRESHMEN:

6:00 to 7:00, p.m., Physics and General Chemistry (Lectures and Recitations).

7:00 to 11:30, p.m., Analytical Chemistry (Lectures, Laboratory and Recitations).

### *Thursday*—SENIORS:

6:00 to 7:00, p.m., General and Organic Chemistry (Lectures and Recitations).

7:00 to 11:30, p.m., Quantitative Chemical Analysis (Lectures, Laboratory and Recitations).

### *Friday*—SENIORS:

10:00 to 11:00, a.m., Materia Medica and Toxicology (Lectures and Recitations).

11:00 to 12:00, a.m., Pharmacy (Lectures and Recitations).

12:30 to 4:30, p.m., Pharmacy (Laboratory work).

### JUNIORS:

6:00 to 8:30, p.m., Microscopy (Lectures, Laboratory and Recitations).

# OFFICERS AND COMMITTEES OF THE NATIONAL COLLEGE OF PHARMACY

|  |                                  |
|--|----------------------------------|
| CHARLES H. STOCKTON, LL.D.....         | PRESIDENT OF THE UNIVERSITY      |
| HENRY E. KALUSOWSKI, M.D., PHAR.D..... | Dean and Chairman of the College |
| LEWIS FLEMER, PHAR.D.....              | Vice-Chairman of the College     |
| HENRY B. FLOYD, PHAR.D.....            | Secretary of the College         |
| HERBERT C. EASTERDAY, PHAR.D.....      | Treasurer of the College         |

## BOARD OF TRUSTEES

(with year of expiration of term of office)

|                           |                               |
|---------------------------|-------------------------------|
| WYMOND H. BRADBURY, 1919  | HENRY B. FLOYD, 1918          |
| FRANK P. WELLER, 1919     | WILLIAM T. KERFOOT, JR., 1918 |
| FRED B. CAMPBELL, 1919    | CHARLES B. CAMPBELL, 1917     |
| GEORGE T. MANKIN, 1919    | HERBERT C. EASTERDAY, 1917    |
| HENRY E. KALUSOWSKI, 1918 | LEWIS FLEMER, 1917            |
| SAMUEL L. HILTON, 1918    | WILLARD S. RICHARDSON, 1917   |

## STANDING COMMITTEES

### *Finance and Business*

|                       |                         |
|-----------------------|-------------------------|
| WILLARD S. RICHARDSON | WILLIAM T. KERFOOT, JR. |
| CHARLES B. CAMPBELL   |                         |

### *Pharmaceutical Education and Conduct of the School of Pharmacy*

|                     |                  |              |
|---------------------|------------------|--------------|
| HENRY E. KALUSOWSKI | SAMUEL L. HILTON | LEWIS FLEMER |
| FRANK P. WELLER     | GEORGE T. MANKIN |              |

### *U. S. Pharmacopœia and Progress of Pharmacy*

|                  |              |                     |
|------------------|--------------|---------------------|
| SAMUEL L. HILTON | LEWIS FLEMER | HENRY E. KALUSOWSKI |
|------------------|--------------|---------------------|

### *National Formulary*

|                   |                |                 |
|-------------------|----------------|-----------------|
| MARTIN I. WILBERT | HENRY B. FLOYD | LYMAN F. KEBLER |
|-------------------|----------------|-----------------|

### *Membership, Publications and Library*

|                |                  |                    |
|----------------|------------------|--------------------|
| HENRY B. FLOYD | FRED B. CAMPBELL | WYMOND H. BRADBURY |
|----------------|------------------|--------------------|

### *Delegates to the Convention of the American Pharmaceutical Association (Atlantic City, September, 1916)*

|                     |                  |              |
|---------------------|------------------|--------------|
| HENRY E. KALUSOWSKI | SAMUEL L. HILTON | LEWIS FLEMER |
| W. S. RICHARDSON    | HENRY B. FLOYD   |              |

## BOARD OF EXAMINERS

HENRY E. KALUSOWSKI, *Chairman*

LEWIS FLEMER  
GEORGE T. MANKIN  
SAMUEL L. HILTON  
BURTON J. HOWARD  
ALEXANDER MUNCASTER

HENRY B. FLOYD  
HOWARD M. BRADBURY  
FRANK P. WELLER  
HENRY H. HAZEN  
MORRIS A. POZEN

## MEMBERS OF THE COLLEGE

PHILIP J. AFFLECK  
WALTER ARMSTRONG  
THOMAS H. ATKINSON  
ROBERT F. BOGGAN  
W. EDWARD BOYD  
WILLIAM D. BRACE  
HOWARD M. BRADBURY  
WYMOND H. BRADBURY  
LOUIS F. BRADLEY  
ALFRED T. BRONAUGH  
V. ALOIS BURGHER  
HOMER K. BUTLER  
CHARLES B. CAMPBELL  
FRED B. CAMPBELL  
ALBERT N. CONNER  
FRANCIS M. CRISWELL  
C. F. W. DAMMEYER  
WILLIAM C. DOWNEY  
ROGER W. DUFFEY  
PETER J. DUNCAN  
HERBERT C. EASTERDAY  
JAMES K. EPPLEY  
HENRY EVANS  
W. ASHTON EVANS  
MARTIN S. FEALY  
LEWIS FLEMER  
HENRY B. FLOYD  
LEOPOLD H. FORSTER  
CHARLES J. FUHRMANN  
CHARLES B. GASS  
MALCOLM G. GIBBS  
T. LEITH GILL  
CHARLES E. GILLETTE  
CHARLES E. GROSS  
ROBERT N. HARPER  
CHARLES HAWKINS  
FRANK C. HENRY  
WILLIAM P. HERBST  
WALTER R. HILL  
SAMUEL L. HILTON  
R. CLIFFORD HINES

S. J. HOHBERGER  
FLORENCE V. HOSKINS  
JAMES T. HOSKINS  
R. VERNON HOUSTON  
JOHN R. JACOBS  
WILLIAM S. JONES  
T. A. T. JUDD  
HENRY E. KALUSOWSKI  
LYMAN F. KEBLER  
WILLIAM P. KENEALY  
WILLIAM T. KERFOOT, JR.  
CHARLES G. LENNON  
J. WILLARD MCCHESENEY  
WILLIAM H. MCCLURE  
GEORGE T. MANKIN  
WILLIAM F. MATTINGLY  
T. K. MELSON  
GUY M. NEELY  
ROBERT C. NELLIGAN  
GAIL E. NELSON  
THOMAS E. OGRAM  
PAUL PEARSON  
R. LUCIEN QUIGLEY  
ALBERT M. READ (honorary)  
EARLE K. RICHARDSON  
FRANK R. RICHARDSON  
SAMUEL A. RICHARDSON  
WILLARD S. RICHARDSON  
FRANK T. STONE  
SAMUEL T. STOTT  
AUGUSTUS C. TAYLOR  
FRANK B. TIPTON  
F. A. TSCHIFFELY  
ROBERT A. VEITCH  
S. M. WAGNER  
CHARLES S. WALTER  
CONRAD H. WEISS  
FRANK P. WELLER  
CHARLES WHITEBREAD  
EDWARD W. WHITESIDE  
MARTIN I. WILBERT



# GEORGE WASHINGTON UNIVERSITY NATIONAL COLLEGE OF PHARMACY

## THE FACULTY

HENRY E. KALUSOWSKI, M.D., Phar.D., Dean of the College, Professor of Pharmacy  
HENRY H. HAZEN, B.S., M.D., Professor of Materia Medica, Botany, and Toxicology  
MORRIS A. POZEN, Phar.D., B.S., Professor of General Chemistry and Physics  
HOWARD M. BRADBURY, Phar.D., Professor of Analytical Chemistry  
BURTON J. HOWARD, B.S., Professor of Microscopy  
HENRY B. FLOYD, Phar.D., Professor of Mercantile Pharmacy  
ALEXANDER MUNCASTER, Phar. D., LL.B., LL.M., Professor of Pharmaceutical Juris-  
prudence

## ASSISTANTS

.....Assistant to the Professor of Pharmacy  
V. ALOIS BURGHER, Phar.D., Assistant to the Professor of Analytical Chemistry

## GENERAL STATEMENT

The forty-fifth annual session of the George Washington University National College of Pharmacy will commence, Wednesday, September 20, 1916. One course of instruction only is offered, as heretofore, that of three years of study leading to the degree of Doctor of Pharmacy. A comprehensive outline of the subject matter of the course, with the plan of study, arranged under proper headings, will be found on page nine and the succeeding pages of this announcement.

George Washington University National College of Pharmacy has many advantages not possessed by other colleges of pharmacy. Its location in Washington, its extensive curriculum, its careful management, and its experienced faculty, unite in producing an idealistic standard for an educational institution.

As an educational center, Washington possesses advantages found in no other city in the United States. Its libraries, the Congressional, the Carnegie (one block from the College) and the Army Medical; the National Museum; the Smithsonian Institution; the Agricultural Department with its chemical laboratories, experimental stations, and drug farm; the Hygienic Laboratory of the Public Health Service; the Botanical Gardens; the National Zoölogical Park; and other publicly and privately owned institutions, of which no duplicates can be found, are available to the student. For the study of materia medica, chemistry, and botany, these advantages are inestimable. Washington, too, is the most beautiful city in the world, and one of the most healthy.

The curriculum of the College is complete as an examination of the syllabus (beginning on page nine) will show. The subjects indicated in the syllabus are thoroughly covered in the order indicated.

Thorough efficiency in the management of the affairs of the College is obtained by the manner in which it is governed. The Members of the College are the leading pharmacists of the District of Columbia, men who are thoroughly conversant with the demands and requirements of the profession. From this body, twelve trustees are selected for terms of three years each, four trustees being elected each year in June. The Trustees keep in close contact with the affairs of the College by frequent meetings given over exclusively to the administration of College matters.

The Faculty is constituted of experienced and successful teachers who are favorably known for their abilities and thoroughness. Every assistance possible is extended by them to the students, each member taking a deep personal interest in the welfare and advancement of the student body. With the classes of the College averaging twenty to thirty-five students, it follows that great individuality of instruction is obtained.

The College Building is most centrally located. Within a short distance of the Washington Railway and Electric and Capitol Traction lines, it may be reached on one fare readily and quickly from any part of the District of Columbia.

The building itself, a three story and basement structure, designed and built in accordance with the ideas of the Board of Trustees, is used for educational purposes only. On the first floor is the main lecture hall, also, the microscopical laboratory. The second floor is devoted to the offices of the College, and to the pharmaceutical laboratory. Working desks for eighty-four students, with racks for apparatus, and drawers and lockers for storage, have been built in this laboratory. One hundred and twenty students may be accommodated in the chemical laboratory located on the third floor, each student being provided with a working desk, racks for apparatus, and storage drawers and lockers. Rooms for the faculty, storage, and other purposes, are located on the several floors.

Each laboratory is amply equipped with modern apparatus and appliances for demonstrations and experimental work.

The demand for the services of graduates of the College is in excess of the supply. The scope of its course, combined with the thoroughness with which it is taught, produce qualities sought and appreciated by proprietors, managers, and manufacturers, and no graduate ever has difficulty in securing lucrative employment, a condition which speaks most favorably for the College.

**REQUIREMENTS FOR ADMISSION**

Beginning with the September, 1916, session, applicants who are over seventeen years of age, and who have had eight years in the graded schools and four years in the high schools of Washington, D. C., or the equivalent thereof, will be admitted to the College.

Evidence of preliminary education should be in the form of certificates from the schools which the applicant has attended, properly signed and authenticated. Each certificate should show the number of years the applicant has attended the school, and the studies pursued.

All applicants for admission to the College whose basic education has been in any language other than the English language, will be required to pass a special examination in English before admission.

A special examination for admission to the College will be held in September 14, 1916, for those applicants who are unable to present satisfactory evidence of sufficient preliminary education.

**HOURS OF INSTRUCTION**

During the first or Freshman year, students are required to attend lectures and laboratory instruction one day and one evening each week. In both the second or Junior year, and the third or Senior year, attendance is required one day and two evenings each week. By this arrangement of the hours of instruction, students, during the entire three years of his course, may be remuneratively employed. The College Calendar and Weekly Program will be found on page two.

**FEES**

The matriculation fee, payable but once, is five dollars, and should accompany the application for admission to the College.

The tuition for each year is as follows:

|                    |         |
|--------------------|---------|
| Freshman year..... | \$90.00 |
| Junior year.....   | 95.00   |
| Senior year.....   | 100.00  |

The Diploma Fee is \$10.00.

Tuition fees are payable, one-half in September upon enrollment, and one-half on or before February 1, 1917.

Students who do not wish to take the entire course but desire to take one or more branches thereof may do so, and upon payment of the fees indicated herein, become entitled to attend the lectures and laboratory work in the subject or subjects selected by them, at the regular period set aside for such subject or subjects.



Students not taking the entire course will be classed as *Special Students* and will not be allowed to take the examinations leading to the degree conferred by the University.

Following is the schedule of fees for *Special Students*:

|  |         |
|--|---------|
| Pharmacy, each year.....                           | \$30.00 |
| General Chemistry and Physics, each year.....      | 20.00   |
| Analytical Chemistry, each year.....               | 25.00   |
| Physiology and Botany (Freshman course).....       | 20.00   |
| Botany and Materia Medica (Junior course).....     | 20.00   |
| Materia Medica and Toxicology (Senior course)..... | 20.00   |
| Microscopy, each year.....                         | 20.00   |
| Mercantile Pharmacy, one year.....                 | 10.00   |
| Pharmaceutical Jurisprudence, one year.....        | 10.00   |

The Pharmaceutical Laboratory fee each year is \$5.00, payable in advance. Of this sum, \$3.00 is retained as a charge for materials used, and the balance, \$2.00, is returned to the student subject to deductions for apparatus broken or lost during the course.

The Analytical Chemistry Laboratory fee is \$5.00, payable each year in advance. Of this sum, \$2.00 is retained as a charge for materials used, and the balance, \$3.00, is returned to the student after deducting for apparatus lost or destroyed during the course.

No student will be permitted to attend any course of instruction unless he shall have paid all fees due to the College. Tickets to each of the courses for which the student enrolls will be issued upon payment of the fees in full.

## EXAMINATIONS

The annual (final) examinations of Senior students for graduation, and for Junior and Freshman students for promotion to the next higher class, will begin May 7, 1917, and continue on such days as the Board of Trustees may determine.

Students intending to take the final examinations must present themselves to the DEAN on or before April 27, 1917, and exhibit to him, their lecture tickets, signed by the Treasurer of the College, and duly endorsed by the proper members of the faculty, to show that the student's attendance has been satisfactory and that his general average of work has been sufficient to entitle him to be examined.

Candidates for graduation must pay to the DEAN, on or before April 27, 1917, the sum of ten dollars as a deposit for diploma fee, the same to be returned should the candidate fail to meet the requirements for the degree.

## RE-EXAMINATIONS

Freshmen and Junior students who receive conditions in the final examinations held in May, 1917, will be given a re-examination in the subject or subjects in which conditioned, in September, 1917. Students who desire to take examinations to remove conditions must so notify the DEAN on or before September 1, 1917.

Students who fail in the final examination in any subject or subjects are not entitled to a re-examination in such subject or subjects until they shall have attended another course of instruction therein.

## THE DEGREE

The Degree conferred by George Washington University upon the graduates of this College, duly recommended by the Board of Trustees, is Doctor of Pharmacy.

## QUALIFICATIONS FOR THE DEGREE

1. The candidate shall have attended three courses of instruction in Pharmacy, General Chemistry, Materia Medica, Botany, and Toxicology, and Analytical Chemistry, and two courses in Microscopy, the last of which must have been in this College, and one course in Mercantile Pharmacy and Pharmaceutical Jurisprudence.

2. The candidate shall have passed a satisfactory examination in each of the branches named.

3. The candidate must be recommended by the Board of Examiners.

## EMPLOYMENT

Any non-resident student who desires employment should write the DEAN of the College, advising him of all qualifications he may have, when an effort will be made to secure such student a position. Usually no difficulty is experienced in obtaining a desirable position.

Additional information may be had by applying in person, or in writing, to the DEAN of the College, who should be addressed as

THE DEAN,  
National College of Pharmacy,  
808 I Street Northwest,  
Washington, D. C.

## THE STUDENT BODY — 1915-1916

### GRADUATES

|   |                      |
|---|----------------------|
| HOWARD LESLIE ARNOLD  | JOHN MARSHALL GAINES |
| ALFRED BLUMBERG   | RALPH S. KIEFER      |
| Ph.M. 1905, Royal Francis Joseph<br>University, Temesvar, Hungary | JAMES W. KELLY       |
| JOHN THOMPSON COLAHAN   | MANUEL B. LEON       |
| B.T. 1902, St. Mary's Seminary,<br>Baltimore, Md.                 | GEORGE VAIL MINNICK  |
| T. FRANCIS DONAHUE  | ARCHIE C. PAINTER    |
| JAMES W. DUDLEY   | ALBERT A. RILEY      |
| JAMES ALBERT FINK   | CLYDE E. SNIDER      |
|   | CLYDE G. WILLIAMS    |

### UNDERGRADUATES

|                          |                       |
|--------------------------|-----------------------|
| BJORGO, RAYMOND E.       | GLYCOFRIDES, ELLIS E. |
| BOWMAN, C. L.            | HELLER, T. J.         |
| BRADSHAW, W. N.          | JOHNSON, P. MARSHALL  |
| BROWN, E. L.             | LI, KANG              |
| BURLEY, ALLAN            | NORRIS, WALTER BENTON |
| DAVIS, PAUL ROSCOE       | NUGENT, FRANCIS X.    |
| DEMENT, W. E.            | PAYEWSKI, PETER J.    |
| FAULKNER, H. L.          | POSTON, L. M.         |
| FLEMER, GEORGE ROOSEVELT | STEWART, W. A. T.     |
| FLEMER, HENRY LEWIS      | THORNTON, LATHA C.    |
| FRAILEY, WILLIAM A.      | WILLIAMS, T. FRANKLIN |

### SPECIAL

|                        |                                    |
|------------------------|------------------------------------|
| FEKAN, MISS FRANCES E. | POTTER, A. A.                      |
| FUHRMAN, W. J.         | B.S. 1909, University of Minnesota |
| HUGHES, STEVENS        | SCHWARTZ, MARTIN S.                |
| JACKSON, O. A.         | WEDDING, WILLIAM C.                |
| JESSUP, CLAUDE E.      | WHITE, GERSHOM F.                  |
| MCINTYRE, JOSEPH D.    | M.D., George Washington Univer-    |
| PAYLOR, RUSSEL S.      | sity, 1909                         |

# SYLLABUS OF LECTURES AND LABORATORY INSTRUCTION

NOTE: Students should preserve this Syllabus as a guide to study.

## PHARMACY

PROFESSOR HENRY E. KALUSOWSKI

.....*Assistant*

This course will be devoted to the study of the various pharmaceutical processes and operations. The opening lecture will define Pharmacy and its relations to the arts and sciences. In the order named will follow lectures on Metrology, Heat, Thermometry, Evaporation, Distillation, Fusion, Sublimation, Calcination, Granulation, Comminution, Solution, Filtration, Clarification, Decoloration, Precipitation, Crystallization, and Extraction, during which the various methods used to bring about the desired results will be explained and illustrated.

The Junior course will be taken up with the study of the official preparations obtained from the mineral kingdom, beginning with Bromine, Chlorine, Iodine, Phosphorus, and Sulphur, and followed in the order named by Carbon, Boron, Silicon, the inorganic acids, Potassium, Sodium, Ammonium, Lithium, Magnesium, Calcium, Barium, Zinc, Aluminum, Cerium, Cadmium, Manganese, Iron, Chromium, Lead, Silver, Copper, Mercury, Antimony, Arsenic, Bismuth, and Gold. The latter part of the Junior course will involve the study of Fixed Oils and Fats, Volatile Oils, Alkaloids, Glucosides, their sources and separation. The animal products will also be considered.

The time during the Senior course will be mainly given to the study of the compounds derived from organic matter, such as Cellulose and products obtained therefrom, Amylaceous, Mucilaginous, and Saccharine substances, Soaps, Resinoids, and products from resins. A systematic instruction in compounding and dispensing prescriptions will follow.

In addition to oral quizzes, students in all classes will be examined at regular periods by a series of written questions covering the subject matter of previous lectures.

## FRESHMAN COURSE

1. Pharmacy defined. Description of Pharmacopœias and Dispensatories. Manner of reading formulæ. Historical sketch of the United States Pharmacopœia.

2. Metrology. The principle and construction of various kinds of balances; their care, method of using, testing.

Weighing. Standards of weight and measure; relation to each other.

Measure of Capacity. Testing balances.

Specific Gravity defined. Methods employed, illustrated by practical application to liquids and solids.

Specific volume. Methods for determination illustrated and applied.

3. Heat. Sources; methods for applying; uses in Pharmacy; manner of regulating and modifying intensity by baths.

Methods for Measurement of Heat. Manner of using thermometers. Relation of the various scales.

4. Evaporation, Principle of. Methods for conducting by heat, in vacuo, under pressure, spontaneously; effects of pressure and saturation of air; boiling point; rate and effects of evaporation and removal of products.

5. Distillation. Principle involved in the process. Construction of apparatus. Simple, fractional and destructive distillation. Manner of using distillatory apparatus. Recovery and treatment of distillates.

6. Fusion, Sublimation, Calcination, and Granulation. Principles and application to pharmacopœial uses.

7. Desiccation and Comminution. Principles involved in construction of mills and cutters explained. Mortars and knives described. Garbling and powdering drugs. Sifting to required degree of fineness; considerations governing fineness of powders; effects of pulverization.

8. Solution. Theory of solution. Saturation. Solvents of the United States Pharmacopœia, classified and considered in groups.

9. Filtration. Explained and illustrated by means of various kinds of apparatus and media. Methods for rapid filtration by aid of heat or in the cold. Use of apparatus to produce vacuum; continuous filtration.

Clarification and Decolorization. Methods for and substances used.

10. Precipitation. Theory of changes that take place and conditions required. Decantation; use of siphon; washing and drying precipitates.

11. Crystallization, Systems of. Measurement of crystals; conditions under which crystallization takes place; purification of crystals.

12. Dialysis and Diffusion. Principles; methods of application and uses.

13. Extraction, General purposes of and common results.

14. Maceration, Decoction and Infusion. Methods for effecting solution described. Official decoctions and infusion. Expression. Purpose of, and methods described.

15. Percolation. Theory and principles; manner of preparing drug, menstruum, percolator and receiver; recovery of percolate; treatment of weak percolates; modified methods for percolation; repercolation described and illustrated.

16. Preparation of aqueous solutions of oils, viscid, mucilaginous, and saccharine substances; cold process for syrups described and illustrated. Official syrups, methods for preparing, description, character of and causes of deterioration.

17. Solutions, Mixtures, and Emulsions. Manner of making and character of compounds described. Glycerites and oleaginous solutions described; manner of preparation illustrated. Vinegars, resins and oleoresins; methods for preparation usually followed illustrated; character and cause of deposits in oleoresins.

18. Alcoholic, Hydro-Alcoholic, Vinous, and Ethereal solutions described. Methods for preparation demonstrated.

Extracts. Selection of drugs and menstrea; methods of concentration; treatment of reserved, concentrated, and finished portions; condition and treatment of weak percolates by distillation.

Reviews will be given at the close of the first half and last half of the course.

## FRESHMAN PHARMACEUTICAL LABORATORY WORK

The instruction is arranged so as to give each student a thorough and practical knowledge of the various Pharmaceutical Processes, the application of which will be facilitated by an ample supply of material and apparatus to properly carry out the purpose of this course. That the work may be carried on according to a definite plan, it has been divided into sections, each of which is intended to be as nearly complete as the character of the process indicated will admit. Students are required to complete the work of each section and submit the results to the instructors for approval before they will be permitted to take up any work on the succeeding section.

1. Students will receive instruction upon the proper use of the Pharmacopœia. By a series of written exercises upon subjects that will be named they will be required to write a description of a number of substances; the order of writing will include the official names, chemical symbols, synonyms, names of the parts or parts used; if a plant, name of natural order, description of substance named, solubility, melting point, tests for identification and names of official substances derived therefrom.

2. Specific Gravity. Methods for taking specific gravity of solids and liquids.

3. Application of heat to determine melting and boiling points, with arrangement of necessary apparatus to carry out a series of trials.

4. Preparation of aromatic waters by solution in hot and cold water, filtering or otherwise clarifying the same.

5. Distillation. Fitting up distillatory apparatus and applying same for preparing distilled waters, recovering alcohol, and for the preparation of not less than two solutions of gases in water and two aromatic waters.

6. Solution. Applied to the preparation of decoctions and infusions and of syrups, mucilages, vinegars, and glycerites.

7. Precipitation, exsiccation and granulation applied to a number of inorganic salts.

8. Percolation, applied to the preparation of a series of products, among which will be included aqueous extracts, hydro-alcoholic extracts and tinctures, with methods for recovery and treatment of alcohol from weak percolates. The preparation of a series of syrups by the "cold process," or percolation, will follow.

9. Upon the conclusion of the course a laboratory examination will be held; this will involve the application of any of the above named processes to the preparation of some product that will be named and material supplied on the date of the examination.



## JUNIOR COURSE

1. Chlorine, Bromine, Iodine, Phosphorus and Sulphur. History, sources, process of production, methods of preparation of officinal compounds, tests for identification.

2. Carbon, Boron and Silicon. Compounds used in Pharmacy and the methods of production.

3. Acids. Preparation, tests, impurities, purification, and pharmacopœial uses; use of hydrometers and specific gravity tables for determining strength thereof.

4. Potassium, Sodium, Lithium and Ammonium. Sources of supply, methods of producing and purifying, pharmacopœial compounds, tests for identity, and composition.

5. Magnesium, Calcium, and Barium. Sources of supply, production of compounds, methods for purification, tests and uses in Pharmacy.

6. Zinc, Aluminum, Cerium and Cadmium. Sources of supply, methods of obtaining the elements, formation of compounds, impurities, tests for identity and composition.

7. Manganese, Iron and Chromium. Methods for obtaining pharmacopœial compounds from these elements, characteristics of, process of purification, tests for; identity and composition; scale salts of iron, their character and preparation.

8. Lead, Copper, Silver and Mercury. Sources of supply, manner of production, characteristics of; pharmacopœial compounds obtained from these elements, tests for purity and identification.

9. Antimony and Arsenic. Sources, production of salts, methods for testing. Toxicology; antidotes and methods of administration.

10. Bismuth. Preparation of pharmacopœial compounds; impurities, separation of; tests.

11. Gold. Officinal compounds; methods for testing.

12. Fixed Oils and Fats; their composition, methods for production and purification, keeping and dispensing. Tests for adulteration, saponification and iodine absorption values demonstrated.

13. Alkaloids and Glucosides, Sources of. Methods for separation, tests for identification, remarks on dispensing, antidotes. Drugs containing neutral, cathartic and astringent principles.

14. Animal Products. Fats, oils, lactic acid, anti-diphtheric serum. Powdered glandular substances. Pepsin. Pancreatin, preparation and methods of testing.

Reviews will be given at the close of the first half and last half of the course.

## JUNIOR PHARMACEUTICAL LABORATORY WORK

1. Preparation and standardization of the following solutions:

Half normal hydrochloric acid solution. Normal potassium hydroxide solution. Decinormal silver nitrate solution. Half normal alcoholic potass. hydroxide. Tenth normal potass. permanganate solution. Decinormal iodine V. S. Decinormal sodium hyposulphite solution. Normal sulphuric acid.

Quantitative and qualitative tests of the following inorganic compounds will be made:

2. Acids: Hydrochloric, Nitric, Phosphoric, Sulphuric, Acetic, Tartaric, and Citric.

3. Chlorinated lime, Iodine.

4. Potassium and Sodium hydroxides, Potassium bitartrate and iodide, Potassium and sodium tartrate.

5. Sodium bicarbonate, borate, bromide and phosphate. Ammonia water.

6. Iron, reduced. Sol. Chloride iron, Citrate iron and quinine.

7. Solution Subacetate lead, Silver nitrate.

8. Antimony and potassium tartrate, Arsenous acid.

9. Determination of the purity of a series of fixed oils and fats by chemical tests, finding of saponification numbers and iodine absorption values.

10. Identification and tests for their purity of some of the commonly used "synthetics."

11. Quantitative assays of opium, nux vomica, belladonna and preparations of alkaloid containing drugs.

Upon the conclusion of the foregoing, a laboratory examination will be held. It will consist of problems involved in any of the above numbered sections; the problems will be announced on the date of the examination.

## SENIOR COURSE

1. Cellulose Group. Products obtained directly and by destructive distillation. Coal-tar products under this head will be specially treated. A number of preparations

classed under the general term of "synthetics," with tests for identification and purity will be considered.

2. Amylaceous, Mucilaginous and Saccharine substances as such, and their more important products, will be taken up and noted according to their value.

3. Derivatives of Sugars through action of ferments. Alcohols and Ethers. Methods by which they are obtained; tests for identification and purity.

4. Aldehyde; its derivatives, preparations and tests.

5. Products obtained by the action of ferments upon Acid and Saccharine Fruits.

6. Soaps. Methods and theory of saponification, purification of by-products.

7. Volatile Oils, Sources. Composition of the more important kinds as shown by recent investigations. Tests for identity and assay methods.

8. Products obtained from Resins, Balsams and Gum Resins. Methods of separation and production in a state of pharmaceutical purity; tests.

9. Methods for producing Resinoids with remarks on their relations to the medicinal properties of the drug from whence they are derived and the system of their nomenclature.

10. Pills. Methods of making masses; hardness and coherence of the same; how regulated by excipients; choice of excipients and functions of absorbing powders; treatment of oils and other liquids in making masses; division and shaping mass into pills; finishing and dusting pills; choice of dusting powders.

11. Pill Coating, Sugar, Gelatine, Chocolate and Foils. Methods for coating and composition of coating materials.

12. Tablet Triturates. Composition; use of excipients; manner of division and methods for forming.

13. Capsules, Composition of. Manner of capsuling pills and powders; capsuling and dispensing liquids; solubility of capsules; conditions affecting the same; care in dispensing.

Wafers, Composition of. Methods for filling and dispensing.

14. Compressed Tablets. Methods followed in preparing the mass and compressing.

15. Troches, Masses and Confections. Medicaments adapted to that form of administration.

16. Powders. Methods for securing uniformity of diffusion in simple and compound powders; dividing, folding and dispensing.

Treatment of Powders. Composed in part or whole of volatile, efflorescent, or deliquescent substances.

17. Suppositories. Hot and cold processes; use of molds; preparation of the mass; incorporating the medicaments; rolling and dividing, shaping; use of molds explained and demonstrated.

18. Plasters. Methods for preparing and spreading. Remarks on dispensing.

19. Ointments. Cerates and other bases for applying medicaments by contact or inunction; methods for preparing; use of heat; necessity for straining and purification from foreign matter; manner of incorporating solution of salts, waters, extracts and powdered substances; preservation of products and methods of dispensing. Oleates. Methods for making by direct combination; solution or decomposition; remarks on their character and qualities.

20. Milk, composition of; seasonal variation. Methods for testing for fats, albuminous substances, sugar, water.

21. Urinary Analysis. General remarks on normal and pathological constituents of urine; variations from normal interpreted; description and application of chemical tests; application and use of the microscope for examining urinary sediments; collection of sediments and methods for mounting described and demonstrated.

Reviews will be given at the close of the first half and last half of the course.

## SENIOR PHARMACEUTICAL LABORATORY WORK

1. Percolation, Various methods of. Applied to making a series of fluid, solid extracts and powdered extracts.

2. Recovery of alcohol from exhausted drugs and weak percolates; determination of the percentage of alcohol in the recovered liquid; instruction for converting it into diluted alcohol of other required strength.

3. Pills, Powders, Capsules, Wafers, Tablet Triturates. Students in this section will be expected to make up a series of these preparations, and will be instructed in the manner of making and methods of dispensing. Pill coating will receive due attention.

4. Mixtures. Methods of preparing official and unofficial mixtures, emulsions of oils, gum resins; resins, liniments, and liquids that are insoluble in aqueous vehicles.



5. Granular Effervescing Salts. Methods for preparing and granulating. Compressed Tablets. Methods for preparing the mixture and compressing.

6. Continuing through this course instruction in prescription work will be given. It will include methods for compounding, and the attention of students will be directed to the details involved in dispensing, and problems in deciphering illegible prescriptions. The treatment of incompatibles, whether chemical, physical, or therapeutical, will receive the attention that their importance justifies. Students will be furnished with copies of prescriptions for compounding. The prescriptions will be selected with the view of presenting difficulties and incompatibilities ordinarily met with in the practice of Pharmacy.

7. Preparation of Scale Salts. This will begin by taking definite quantities of solution of tersulphate of iron and following each step to the production of the finished scale.

8. Suppositories, Oleates, Plasters, Ointments and Cerates. Instruction in preparation and methods for dispensing.

9. Upon the conclusion of the work indicated in each section a laboratory examination will be held. It will involve the production of some compound or compounds included in any of the sections; the nature of the product or products required will be announced on the date of examination; necessary material for working will be supplied.

## MATERIA MEDICA, BOTANY AND TOXICOLOGY

PROFESSOR HENRY H. HAZEN

The Freshman course includes an introduction into the study of Animal Physiology, including Body Tissues, Bone, Fibre, Cartilage, Muscle, Epithelium, Serous Tissue, Nerve Tissue, Blood, and the Circulation. Botany, covering the properties of Living Organisms and the Growth, Internal Structure, and Physiology of Plants, will next be considered, and will be followed by a description and study of the Natural and Artificial Systems of Botany.

In the Junior year, the course includes Causes of Disease, Trauma, Poisons introduced from without, Bacteria and Immunity, General Principles of Therapeutics, Rules for Dosage, Standardization of Drugs, followed by the study of Drugs classified as to their general or local effects.

The Senior course covers a general review of the Junior work, and a continuation of the study of drugs to include the coal tar group, toxins, anti-toxins, vaccines, bacterins, and the use of drugs hypodermically. This course is concluded with a special course of instruction in Toxicology.

### FRESHMAN COURSE

#### *Physiology*

1. The body tissues, Bone, Fibrous Tissue, Cartilage, Muscle, Epithelium, Serous Tissue, Nerve Tissue, Organs of Special Sense, Blood, Lymph.
2. The Circulation.
3. Respiration.
4. Digestion.
5. Lymphatic System.
6. Genito-urinary System.
7. Nervous System.
8. Internal Secretions.

#### *Botany*

9. Differences between animals and plants, Habitat of Plants, Development of Plant Form, Essential parts of plants, the Stem, including external structure, direction, special modifications.

10. The stem, *continued*, Internal Structure, Buds.
11. Leaves, Venation, Shape, Leaf Margin, Petiole, Photosynthesis, Structure.
12. Leaves, *continued*, Transpiration, Growth, Fall, Respiration, Special Modifications.
13. Roots, General Description, Root cap, Root hairs, Internal Structure, Soils, Special Modifications.
14. Germination of Seeds.
15. Classification of Plants.
16. Flagellates, Myxomycetes, Bacteria, Cyanophyceae, Diatomae, Peridineae.

17. Conjugatae, Chlorophyceae, Phaeophyceae, Rhodophyceae, Characeae, Hyphomycetes, Lichenes.
18. Bryophytes, Hepaticae, Musci, Pteridophyta, Filicae, Equisetinae, Lycopodinae.
19. The Flower, Anthotaxy.
20. The Flower, Principal Parts, the Calyx, the Corolla.
21. The Stamen System, the Pistil System, Seeds, Fruit.

## JUNIOR COURSE

### *Botany*

1. Angiosperms, Monocotyledons.
2. Dicotyledons.
3. Dicotyledons *continued*.
4. Dicotyledons *continued*.

### *Materia Medica*

5. The Causes of Disease, Trauma, Poisons introduced from without, Bacteria, Infection, and Immunity.
6. Animal Parasites, Vegetable Parasites other than bacteria, Diseases due to improper functioning of organs.
7. Diseases of Unknown Etiology. General Principles of Therapeutics.
8. Rules for Dosage. Specific Drug Therapy.
9. Corrosives and Caustics.
10. Antiseptics and Disinfectants.
11. Astringents and Styptics.
12. Demulcents and Emollients.
13. Flavoring Substances, Simple Bitters, Volatile Oils.
14. Local Anodynes.
15. Drugs acting upon the Stomach, Simple Bitters, Nux Vomica and Strychnine, Cinchona, Carbonates and Bicarbonates, Digestives.
16. Emetics.
17. Drugs acting upon the Intestines, Intestinal Ferments, Laxatives.
18. Drugs checking peristalsis, Intestinal Antiseptics.
19. Anthelmintics.
20. Drugs affecting the Circulation, Drugs strengthening the contraction of the heart muscle, those increasing the heart rate, those slowing heart.
21. Drugs raising the Blood Pressure, those lowering the Blood Pressure, those arresting Haemorrhage, those removing fluid in Dropsy.

## SENIOR COURSE

### *Materia Medica*

1. Diuretics, Drugs rendering urine less acid, Urinary Antiseptics.
2. Ecboics, Emmenagogues.
3. Drugs stimulating the Respiratory Center, those reducing irritability of the Respiratory Center, those liquefying bronchial secretions.
4. Drugs lessening secretions of the Bronchi, those relaxing bronchial spasm in asthma, Bronchial Antiseptics.
5. Drugs stimulating the Spinal Cord, those stimulating the Brain and Medulla.
6. Anaesthetics, Narcotics, Analgesics.
7. Drugs acting on the Peripheral Nerves.
8. Antipyretics.
9. Drugs affecting the Liver, those affecting the Blood.
10. Drugs used for Specific Disease.
11. Drugs used upon the skin.
12. Drugs affecting other special organs.
13. Bacterins, Antitoxins, Vaccines.
14. Visit to laboratory producing biological products.
15. Drugs used hypodermatically.
16. Introduction to Toxicology.
17. Inorganic Poisons.
18. Organic Poisons.
19. Gaseous Poisons.
20. Food Poisons.

# GENERAL CHEMISTRY AND PHYSICS

PROFESSOR MORRIS A. POZEN

The subjects of Analytical Chemistry and Pharmacy being fully provided for in other courses, the exercises in General Chemistry will be primarily devoted to a rational presentation of the fundamental principles which underlie a thorough and systematic knowledge of Chemistry. Because of the intimate connection existing between Chemistry and several branches of Physics, a number of lectures illustrating the more important laws and principles of some of these branches will precede the regular course in Chemistry. In order that the exercises in General Chemistry and in Analytical Chemistry may be perfectly correlated during the first year, the preliminary lectures in Physics have been equally divided between the two courses. Aside from Physics, the first year will be devoted to the detailed study of the most common elements and the more fundamental chemical theory.

In the second year the subjects of Light, Magnetism and Electricity, with special reference to their chemical (and, in the case of Light, microscopical) application, are treated in the first four lectures, the remainder of the year being devoted to the study of the elements in groups, based upon Mendelejeff's classification.

The third year will be devoted to the exposition of the more important facts, principles, and theories of Organic Chemistry, including descriptions of the important compounds, as well as of the larger classes and groups of the fatty and aromatic series, which latter are gaining wider use and importance in Pharmacy. The value of an acquaintance with the elements of Physiological Chemistry is so great that two or three lectures are given at the close of the third year on this subject.

Attention will be directed to the law of mass action, equilibrium, the periodic arrangement of the elements and the principles of colloid chemistry in their bearing on theoretical and practical pharmacy. Modern industrial processes used in the manufacture of medicinal chemicals will be discussed thoroughly. Additions and revisions will be made in accordance with advances in the science.

Quizzes will be heard frequently throughout the three years.

## FRESHMAN COURSE

1. Physical and chemical phenomena. Physical agents. Matter. Molecular theory. Properties of matter. Force. Molar and molecular forces. Different states of aggregation.

2. Dynamics of liquids. Compressibility; pressure and equilibrium; buoyant force; density; capillarity; diffusion; osmosis; dialysis; siphon; pumps.

3. Pneumatics: Physical properties of gases, the atmosphere, barometer, compressibility and expansibility of gases; air pump. Gas laws and their application. Diffusion; absorption.

4. Review.

5. Examination in Physics.

6. Substances and properties; changes in substances. Physical and chemical changes. Reagents and reactions. Matter and energy. Elements, compounds and mixtures. The field of chemistry.

7. Oxygen: The air and chemical changes. Preparation and properties of oxygen. Oxidation and oxides. Combustion, flames. The safety lamp. Energy and chemical change. Importance and uses of oxygen.

8. Measurement of gases. Volume, temperature and pressure relations. Gas laws. Temperature and pressure corrections.

9. Hydrogen. Occurrence, preparation, generators. Properties, Reduction, occlusion. Combustion of hydrogen and oxygen. Uses.

10. Water. Nature, electrolysis of. Composition proved by analysis and synthesis. Steam. Laws of definite proportions. Occurrence, natural waters, drinking water, purification. Properties of water. Hydroxides. Equivalent weights.

11. Solution and crystallization. Nature and theory of solution. Properties of solutions. Solubility of solids, liquids and gases. Saturated and supersaturated solutions. Energy changes during solution; freezing mixtures. Crystallization. Precipitation and efflorescence. Water of crystallization. Efflorescence and deliquescence. Drying agents.

12. Fundamental laws and theories. Classes of reactions. Conservation of matter. Law of multiple proportions. The atomic theory and law of definite proportions. Atomic

weights. Atoms and molecules. Properties of molecules. The molecular theory and physical state.

13. Equations and nomenclature. Symbols, formulas and equations. Radicals. Calculations from formulas and equations. How compounds are named. 1

14. Review.

15. Examination in chemistry.

16. Chlorine. Occurrence. Laboratory and industrial methods of preparation. Properties. Liquid chlorine. Industrial and pharmaceutical uses. Nascent state.

17. Hydrochloric acid. Occurrence, preparation, properties and uses. Proof of composition. Chlorides.

18. Valence. Meaning, standard. Formula types based on valence. Valence of radicals. Multiple valence.

19. Review.

20. Molecular weights. Gay-Lussac's law. Avogadro's hypothesis. Molecular weights of gases. Gram-molecular weight and volume. Osmotic pressure. Methods of obtaining exact molecular weights.

21. Atomic weights; determination. Definition. Dulong and Petit's law. Application of atomic weight methods.

22. Acids, bases and salts. Neutralization. Classes of oxides and their action with acids and bases. Normal, acid and basic salts. Basicity and acidity. Equivalent solutions of acids, bases and salts. Nomenclature.

23. Review.

24. Ionization. Double decomposition. Freezing points; electrical conductance of solutions. Dissociation in solution, theory. Explanation of neutralization. Degree of ionization. Replacement. Electromotive series. Electro-chemical equivalents. Electrolysis. Hydrolysis.

25. Nitrogen and the atmosphere. Occurrence of nitrogen; preparation, properties. Character of the atmosphere. Composition. Weight and pressure. Liquefaction of air. Properties of liquid air. Proof that air is a mixture.

26. Ammonia. Occurrence, preparation, commercial sources, properties, uses in pharmacy, liquefaction, use as refrigerating agent. Ammonium hydroxide and ammonium salts. Dissociation of ammonium compounds. Composition of ammonia and proof of same.

27. Review.

28. Molecular formulas and equations. Molecular equations. Determination of a formula. Constitutional formulas. Isomers, polymers, classification.

29. Nitrogen acids and oxides. Nitric acid, preparation, properties, action on metals. Oxidizing action. Uses. Aqua regia. Nitrates, sources, importance and uses. Nitrous acid. Oxides of nitrogen. Hyponitrous acid.

30. Review.

31. Review.

## JUNIOR COURSE

1. Light; its nature, sources, velocity; reflection; mirrors; refraction; total reflection; prisms; spectra; etc.

2. Light, *continued*: Lenses; images; chromatic and spherical aberration; compound microscope; undulatory theory; color phenomena.

3. Magnetism: its nature, production, peculiarities and uses. Frictional and dynamical electricity; induction, potential, electro-chemical decomposition, electro-chemical series, cell, battery, etc.

4. Dynamical electricity, *continued*: Electrolysis and the ion theory; secondary batteries; electrical measurements; dynamos; physiological effects of electricity; application in medicine.

5. Equilibrium, physical, chemical and ionic. Mass action defined and illustrated.

6. Sulphur. Occurrence, preparation, allotropism, properties and uses. Compounds of sulphur. Hydrogen sulphide. Sulphides, precipitation, solubility, importance in qualitative analysis. Carbon bisulphide. Oxides and acids of sulphur. Contact and lead chamber processes for the manufacture of sulphuric acid. Purification, properties and uses. Sulphates. Thiosulphates.

7. Carbon. Allotropic modifications. Uses. Carbon dioxide, occurrence, preparation, properties, sources and uses. Fermentation, baking powders. Relation to life. Carbonates and bicarbonates. Carbon monoxide, preparation, properties, toxicity, uses. Illuminating gas. Water and coal gas. Pintsch and producer gas. Cyanogen, hydrocyanic acid and cyanides. Hydrocarbons.



8. Flames, light and heat. Luminosity and structure of flames. Non-luminous flames. Heat and light of flames. Candle power. Oxidizing and reducing flames. Sources of heat. Smoke. Energy changes accompanying chemical change. Heat of formation and decomposition. Exothermic and endothermic reactions.

9. The halogens. Chlorine. Definition. Halides. Bromine and iodine. Occurrence, preparation, properties, compounds, uses. Fluorine and hydrofluoric acid. Glass. General review and comparison of the halogen family.

10. Ozone and hydrogen peroxide. Review oxygen. Ozone, preparation, properties. Hydrogen peroxide, preparation, properties, composition, test for, uses.

11. The nitrogen family. Phosphorus, antimony, arsenic and bismuth. Review nitrogen. Occurrence, preparation, properties, compounds. Uses in pharmacy and industries. Toxicology. Detection in cases of poisoning. Review of this group.

12. The periodic system. Natural families. Regularities and gaps in the periodic arrangement. Properties of an element determined by the periodic arrangement. Prediction of unknown elements. Periodic table. The argon family. Conclusion and summary.

13. Silicon and boron. Occurrence, preparation and properties. Silicon compounds, silicates, glass. Boron compounds. Boric acid and borates, preparation, occurrence, properties, uses.

14. Metals. Metals and non-metals. Occurrence and extraction of metals. Alloys. Amalgams. Classification of metals. Electromotive series. Metallic compounds.

15. The alkali metals. General properties. Sodium and potassium and their compounds. Occurrence, preparation, industrial processes, uses in industry and pharmacy. Stassfurt deposits. Le Blanc and Solvay processes. Electrolytic alkali industries. Soap.

16. Lithium, caesium, rubidium and ammonium compounds. Occurrence, preparation and uses. Summary of the alkali metal group.

17. The alkaline-earth metals. Calcium as a type of this group. Occurrence, preparation, compounds, properties and uses. Plaster of paris. Water softening. Phosphates. Mortar, cements and concrete.

18. The alkaline earths, *continued*. Strontium and barium and their compounds compared with calcium and its compounds. Spectrum analysis.

19. Magnesium, zinc, cadmium and mercury. Occurrence, preparation, important compounds, uses. Pharmaceutical applications. Amalgams.

20. Copper, silver and gold. Occurrence, metallurgy, properties, compounds, uses. Photography.

21. Aluminum. Occurrence, metallurgy, properties, compounds, uses. Alums. Mordants; clays; porcelain, stoneware and earthenware.

22. Iron, nickel and cobalt. Occurrence and metallurgy of iron. Cast and wrought iron. Steel, steel alloys, special steels. Properties and salts of iron. Pharmaceutical preparations. Nickel and cobalt and their compounds. The use of metallic catalysts in the hydrogenation of oils and fats.

23. Manganese and chromium. Occurrence, metallurgy, properties and compounds. Manganates and permanganates and their oxidizing action. Oxidation by chromates and dichromates. Applications in quantitative analysis.

24. Lead, tin and platinum. Occurrence, metallurgy, properties, important compounds, uses. Industrial applications.

25. Other sessions will include quiz- and review-periods at appropriate intervals; also mid-year and final examinations.

## SENIOR COURSE

1. Organic chemistry. Definition. General properties and common sources of organic compounds; methods of purification; physical constants and their application.

2. The elements more commonly found in organic compounds; methods of analysis; empirical, rational and structural formulas; isomerism; classification.

3. The hydrocarbons—methane and ethane. Homologous series. Halogen derivatives of methane and ethane: Oxygen derivatives: Alcohols.

4. Methyl and ethyl alcohol. Fermentation. Ethers. Ethyl ether, mixed ethers.

5. Aldehydes of methane and ethane. Chloral. Acids: Formic and acetic acids; acid anhydrides. Structural relation between hydrocarbons, alcohols, aldehydes and acids.

6. Esters or ethereal salts. Ketones. Sulphur derivatives of methane and ethane.

7. Nitrogen derivatives of methane and ethane; Cyanogen, hydrocyanic acid, ferro- and ferri-cyanides, cyanides and isocyanides, cyanates and isocyanates, etc.

8. Substituted ammonias, amines or amino compounds. Nitro compounds. Metallic derivatives.

9. The marsh gas series of hydrocarbons or paraffins. Petroleum, its refining. Isomerism among the paraffins.

10. Oxygen derivatives of the higher members of the paraffin series; characteristics of normal, secondary, and tertiary alcohols. Higher aldehydes and fatty acids; soaps.

11. Polyacid alcohols and polybasic acids; oxalic acid, etc.; glycerine, fats, saponification.

12. Mixed derivatives of the paraffins. Hydroxyacids, glycolic, lactic, malic, tartaric, citric, saccharic, mucic acids, etc.

13. Carbohydrates: Glucoses, saccharoses; celluloses, gums. Polarization.

14. Mixed compounds containing nitrogen: Amido acids, acid amides. Unsaturated carbon compounds; ethylene, acetylene.

15. Aromatic compounds: The benzene series of hydrocarbons and derivatives. Theory of the benzene ring. Isomerism among benzene derivatives. Benzene, toluene.

16. Halogen substitution- and addition-products of benzene; nitrobenzene, aniline, acetanilide, phenacetine, toluidine, diazo-compounds, dyes, etc.

17. Phenols and cresols, creosote, picric acid, thymol, etc.

18. Benzyl alcohol benzaldehyde, benzoic acid, salicylic acid, etc. Naphtalene, anthracene.

19. Pyridine bases, terpenes, camphors, glucosides, vegetable and animal alkaloids, proteins.

20. Physiological chemistry: Chemical changes in plants and animals.

21. Physiological chemistry, *continued*: Animal fluids and tissues.

Quiz and review periods at appropriate intervals; also mid-year and final examinations.

## ANALYTICAL CHEMISTRY

PROFESSOR HOWARD M. BRADBURY

V. ALOIS BURGHER, *Assistant*

The instruction in this department is intended to present to the student the chemical tests of the United States Pharmacopœia; to familiarize him with methods for the identification of substances and for the detection of impurities; to instruct him in the methods of assaying and the use of volumetric solutions, and to enable him to analyze any ordinary mixture of inorganic material.

The course of instruction embraces three years of practice in the chemical laboratory and class-room exercises.

The laboratory is provided with the usual water and gas facilities, and has been wired and installed with electric apparatus whereby electro-chemical methods of analysis can be taught. The application of the electric current to the preparation of chemicals by the methods of electro-chemistry can also be illustrated before the students. The laboratory is provided with ample hood facilities for keeping the atmosphere of the room as free as possible from deleterious fumes, and is equipped with means for giving an ample supply of distilled water. These and other facilities afford students exceptional opportunities to become familiar with the fundamental principles of the science of chemistry.

The first year is devoted to experimental work so arranged as to supplement the lectures in General Chemistry. The student attains a knowledge of elementary principles, becomes familiar with the manipulation of apparatus, and is prepared to commence analytical work.

The second year covers a systematic course in Qualitative Analysis in connection with the tests of the United States Pharmacopœia.

The third year is devoted to Volumetric Analysis by means of the standard solutions of the Pharmacopœia.

## FRESHMAN COURSE

### *Introduction to Laboratory Practice*

1. Care of apparatus, rules to be observed in laboratory work, importance of recording results, methods for recording such results.

2. Measurements, Fundamental Units.

3. Archimedes' Principle, Density.

4. Thermometers, Expansion of Gases and Liquids, Maximum density of Water.



5. Heat and Energy, Conduction, Convection, Boiling.
  6. Examination in Physics.
  7. Evidence of Chemical Change and distinction from Physical Change.
  8. Qualitative study of chemical phenomena.
  9. Experiments illustrating the law of Definite Proportions.
  10. Combining Weights and Equivalents.
  11. Law of Multiple Proportions, Making Formulas and Equations, Calculations in Chemistry.
  12. Review.
  13. Oxygen, Sources, Preparation, and Properties.
  14. Oxygen obtained by the employment of a catalytic agent, Oxidation and Combustion.
  15. Hydrogen obtained by the interaction of acids and metals.
  16. Hydrogen obtained by other methods.
  17. Experiments illustrating physical and chemical properties of Hydrogen.
  18. Reduction by means of Hydrogen.
  19. Review.
  20. Purification of Water. Union of Water with Oxides.
  21. Chemical Properties of Water. Hydrates.
  22. Solutions of gases in liquids.
  23. Solutions of liquids in liquids.
  24. Solution of solids in liquids. Saturated Solutions.
  25. Properties of Solutions, Vapor Pressure and Boiling Point, Volume Changes and Thermal Effects.
  26. Review.
  27. Preparation of Chlorine. Properties of Chlorine.
  28. Preparation of Hydrogen Chloride, Properties of Hydrogen Chloride and Hydrochloric Acid.
  29. Composition of an Oxide of a Metal. Equivalent Weight of a Metal by displacing Hydrogen.
  30. Determination of Atomic Weight. Dulong and Petit's Law.
  31. Review.
  32. Preparation of Bromine. Properties of Bromine, Preparation of Hydrogen Bromide, Properties of aqueous Hydrobromic Acid.
  33. Preparation of Iodine, Properties of Iodine, Preparation of Hydrogen Iodide.
  34. Preparation of Hydriodic Acid, Properties of Hydriodic Acid. Hydrogen Fluoride.
  35. Reducing Action of Hydrogen Iodide and Hydrogen Bromide. Identification of Halogen Compounds.
- The results of all experiments are required to be recorded in note books which are criticized each week.

## JUNIOR COURSE

### *Qualitative Analysis*

1. Qualitative analysis; description of operations and apparatus used in analysis; terms defined.
2. Classification of the elements for qualitative analysis; classification of the elements for other purposes.
3. Bases divided into groups by means of reagents. Alkali group: Potassium, sodium, ammonium, lithium.
4. Symbols, formulas, and equations used in recording the results of analysis. Preliminary reactions of the calcium group: Barium, calcium, strontium and magnesium.
5. Calcium group continued. Equations explanatory of the chief reactions; study of the group by the scheme of analysis.
6. Iron and zinc groups. Preliminary reactions with reagents, such as alkali hydroxides, carbonates, sulphides, phosphates, etc., with the metals of this group.
7. Iron and zinc group continued. Writing equations under this group; study of the group by means of the scheme of analysis.
8. Iron and zinc group, *continued*. Analysis and identification of the members of the group in presence of phosphates and interfering substances.
9. Copper group, division B. Preliminary reactions with test substances; writing equations.
10. Copper group, division B, *continued*. Study of group by the scheme of analysis.

11. Tin group (arsenic, antimony and tin). Preliminary reactions with test substances; study of the methods of separating arsenic and antimony.
12. Tin group continued. Separation from the copper group; analysis and identification by the scheme; equations.
13. Silver group. Tests and analysis by the scheme; equations.
14. Separation of the groups of metals and the identification of members in each group.
- 15, 16, 17. Continued drill on the use of the scheme of analysis for the detection of bases in inorganic mixtures.
18. Acid-forming elements. Acids—monobasic, dibasic, tribasic; theory of their structure; tests for sulphides, carbonates, nitrates, sulphates, sulphites.
19. Analysis of salts of unknown metals combined with hydrosulphuric, carbonic, nitric, sulphuric and sulphurous acids.
20. Acids, *continued*. Tests for halogen acids—hydrochloric, hydrobromic, hydriodic—and their separation.
21. Analysis of salts of metals combined with the halogen acids.
22. Halogen acids, *continued*. Tests for hydrocyanic, hydroferro- and hydroferri-cyanic acids and their separation from each other.
23. Analysis of salts containing metals in combination with preceding acids.
24. Hydrochlorous, chloric, boracic and hydrofluoric acids.
25. Acids of phosphorus, hypophosphorous, phosphoric, pyro- and metaphosphoric acids.
26. Final review of the schemes of analysis.
27. Practical laboratory examination.

## SENIOR COURSE

### *Quantitative Analysis*

1. Quantitative analysis; gravimetric; volumetric; standard and normal solutions; indicators, theory and use of.
2. Apparatus used in volumetric analysis; care, use, methods of calibration and corrections applied.
3. Theory of solution. Principles of chemical combination as applied to problems in volumetric analysis.
4. Preparation of pure, dry hydrogen chloride and standardization of normal sodium hydroxide V. S. with a solution of a definite weight of it.
5. Acidimetry. Determination of samples of hydrochloric and diluted hydrochloric acid.
6. Standardization of normal sulphuric acid V. S. with normal sodium hydroxide V. S. Alkalimetry. Determination of samples of ammonia water and stronger ammonia water.
7. Standardization of normal hydrochloric acid V. S. with normal sodium hydroxide V. S. and preparation of tenth-normal hydrochloric acid V. S. Determination of samples of lime water.
8. Residual titrations. Determinations of samples of potassium and sodium tartrate.
9. Determination of samples of ammonium carbonate.
10. Determination of hydroxides and carbonates together.
11. Determination of samples of aromatic spirit of ammonia.
12. Preparation of tenth-normal silver nitrate V. S. Analysis by precipitation. Determination of saturated solution of potassium iodide.
13. Analysis by oxidation. Standardization of empirical solution of potassium permanganate with metallic iron of definite purity.
14. Determination of samples of hydrogen peroxide by means of empirical solution of potassium permanganate.
15. Standardization of tenth-normal oxalic acid V. S. with tenth-normal sodium hydroxide V. S. Preparation of tenth-normal potassium permanganate V. S., by mixing two solutions of different strengths in proportion based upon the quantity of each required to react with a definite quantity of tenth-normal oxalic acid V. S.
16. Determination of samples of ferrous sulphate by means of tenth-normal potassium permanganate.
17. Standardization of tenth-normal potassium dichromate V. S. with tenth-normal sodium hydroxide V. S. Determination of samples of ferrous sulphate by means of tenth-normal potassium dichromate V. S.
18. Determination of ferrous and ferric salts together.

19. Iodometry. Standardization of tenth-normal sodium thiosulphate V. S. with tenth-normal potassium dichromate V. S.

20. Determination of samples of solutions of ferric chloride by means of tenth-normal sodium thiosulphate V. S.

21. Determination of samples of tincture of ferric chloride by means of tenth-normal sodium thiosulphate V. S.

22. Determination of samples of tincture of iodine for iodine and potassium iodide content.

23. Standardization of tenth-normal iodine V. S. with tenth-normal sodium thiosulphate V. S. Determination of samples of Fowler's solution.

24. Combined process for determination of samples of phenol and standardization of empirical solution of bromine.

25. Estimation of solution of formaldehyde by means of fifth-normal potassium permanganate V. S., using residual titration method with empirical solution of peroxide of hydrogen (Free Zeit 40-587).

26. Estimation of sugar by Fehling's solution. Determination of glucose in syrups.

27. Practical laboratory examination.

## MICROSCOPY

PROFESSOR BURTON J. HOWARD

The course of Microscopy is intended to give instruction in the use of the compound microscope as an aid in the study and identification of drugs. Attendance upon this course is required of Junior and Senior students.

The work will consist of both lectures and laboratory work, the exact details connected with each section of the plan of instruction will be clearly set forth as the course progresses.

The first part of the instruction will include the proper manipulation of the microscope and such features concerning microscopic technique as will be most necessary to students of Pharmacy.

After these studies the work will consist of the examination of plant tissue as illustrated in various vegetable substances most familiar to pharmacists. Special attention will be given to the structural characteristics by which one drug can be distinguished from another as well as the detection and identification of the most common adulterants used.

The importance of a knowledge of starches as a means of identification will involve a study of the more common ones, and will constitute an important feature in the first part of the course. The various parts of the plant organism will then be studied microscopically, using drugs as the basis of material. This will require in some cases the use of fresh material while in others dried samples will be used. Drugs commonly used in the powdered condition will first be examined in the entire state by means of sections, after which the powdered form will be studied.

## JUNIOR COURSE

[NOTE.—The following outline will give some idea as to the character and order of studies for the Junior Course, though it may be found necessary to change the order as well as some of the illustrative matter:]

1. Optics of microscopes: Refraction of light, simple lenses, chromatic aberration, spherical aberration.

2. Forms of simple magnifiers. The compound microscope. Types of objectives.

3. Numerical aperture, mechanism of compound microscopes, micrometry of simple lenses, of compound microscopes.

4. Laboratory tests for focus, determination of magnification in magnifiers, in compound microscopes.

5. Micrometry work.

6. Study of starches: Wheat, potato, arrowroot, corn, rice, cassava, rye.

7. Woods: Elements constituting woods, in angiosperms, in gymnosperms.

8. Woods: Quassia, yellow sandal wood.

9. Microchemical tests: For cellulose, for lignified tissue.

10. Types of calcium oxalate crystals.

11. Stems: Lobelia stem, dulcamara stem.

12. Leaves: General histology of.

13. Leaves: Senna, buchu, tea, hyoscyamus, mullein.

14. Barks: General histology of.

15. Barks: Oak, cascara, cinnamon.



## SENIOR COURSE

1. Seeds: Structure, embryo, coverings, reserve materials.
2. Seeds: Mustard seed, linseed, coffee, nux vomica.
3. Fruits: Cardamom fruit, capsicum, pepper, wheat.
4. Rhizomes: General structures.
5. Rhizomes: Arnica, ginger.
6. Roots: Dandelion root, chicory, ipecacuanha.
7. Some common adulterants: Cocoonut shells, olive pits, cracker crumbs, turmeric.
8. Practical work: Consisting of practical work in the identification of mixtures of substances which have been studied during the Junior and Senior courses.

## MERCANTILE PHARMACY

PROFESSOR HENRY B. FLOYD

### SENIOR COURSE

The object of the course in Mercantile Pharmacy is to familiarize the student with modern business methods.

Double-entry Book-keeping, capable of practical application in retail pharmacies, is taught by actual practice sets involving the usual transactions of the pharmacist. Each step, opening the books, journalizing, posting, trial balance, and closing the books, will be carefully covered. The planning and preparation of special forms to facilitate the work of the book-keeper, as well as the conversion of single-entry books into the double-entry system, will be part of the actual practice work of the course.

Each student will be required to familiarize himself with notes, drafts, checks, statements, bills, and other commercial forms. Such forms as are required for use in connection with the practice book-keeping sets will be made by the student.

The lectures, in addition to covering book-keeping methods, commercial and business law (contracts, agency, partnership, corporations, property, insurance, bankruptcy, and bills and notes) will include business correspondence, banking, and business practice. Under the last mentioned heading, such matters as planning the new store, its stock and its policies; advertising, purchasing and selling methods; and manufacturing will be considered.

Written and oral quizzes will be given from time to time, and at the close of the course, a written examination covering the subject matter of the course will be held.

## PHARMACEUTICAL JURISPRUDENCE

PROFESSOR ALEXANDER MUNCASTER

### SENIOR COURSE

A course of twelve lectures is given to the Senior Class upon the rights and responsibilities of Pharmacists and the general and special laws bearing upon the practice of Pharmacy.

**SYNOPSIS.**—Historical sketch of the law in general; Constitution of the United States; State Constitutions; Federal laws, with especial reference to the Food and Drugs Act of June 30, 1906, known as the "Pure Food Law," opium, narcotic and special acts relating to Pharmacy in the District of Columbia; right to practice Pharmacy and the law in regard to prescribing; liability of retail, wholesale and manufacturing pharmacists for negligence; contributory negligence, etc.

Students will be expected to take notes. The class will be quizzed during the course, and a written examination held at the termination thereof.

## TEXT BOOKS

(Students are cautioned not to purchase text books until directed to do so by the members of the faculty.)

A First Course in Physics (Millikan and Gale); Qualitative Chemical Analysis (Prescott and Johnson); A Manual of Volumetric Analysis (Coblentz and Vorisek); Foods and Drugs (Greenish); Practice of Pharmacy (Remington); Pharmacology and Therapeutics

(Cushny); United States Pharmacopoeia; Poisons (Tanner); Manual of Chemistry (Simon); Art of Compounding (Scoville); Physiology (Pearce and MacLeod); Pharmaceutical Botany (Youngken); Essentials of Chemistry (Hessler and Smith); Introduction to the Compounds of Carbon (Remsen); and others to be announced.

### REFERENCE BOOKS

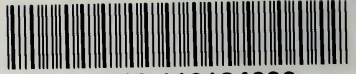
Pharmaceutical and Medical Chemistry (Sadtler and Trimble); second edition, volume 1; Roscoe's and Schorlemmer's Chemistry; Taylor's Toxicology; Maisch's Organic Materia Medica; United States and National Dispensatories, Incompatibles in Prescriptions (Ruddiman); Morphology and Histology of Plants (Rusby and Jelffe); Caspari's Practice of Pharmacy; Pharmacology (Tyrode); Holland's Medical Chemistry and Toxicology; Text Book of Inorganic Chemistry by Holleman (Cooper); College Botany (Bastin); The Microscope (Gage); The Microscopy of Vegetable Foods (Minton) and others to be announced.







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